Abstract

A hypothesis on current surface/sub-surface life on Mars is presented and discussed, with experimental confirmation of its viability.

Life on Mars

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1 Intro

I have previously established, through Complete Relativity[1] (CR), that Earth is a living organism[2]. All terrestrial planets are of the same or similar species, or at least belong to same class of life.

In this ecosystem, Venus and Mars are fully formed, while Earth is still forming upper brain layers.

Ongoing neurogenesis is the only reason why favorable conditions for complex life on the surface of a planet exist.

In formed planets, complex life should reside wherever such life is possible.

Energy for this life may be provided by the host star, may come from gravitational compression and residual radioactivity. However, most significant energy [transformation] source should be the active core, mimicking the energy transformation process in the Sun.

This cannot be thermonuclear fusion, but, based on recent research and overall understanding of metabolisms in living creatures, I am convinced it is, at least in some cases a low energy nuclear fusion process, having a major role in [re]generation of planetary tissue.

Understandably, this also implies cyclic replenishment of fusion fuel.

In a living planet, most complex life should reside within the mantle layers. This, however, does not forbid the existence of simpler life on the surface or in the crust of developed planets too.

If conditions allow it, it would be surprising not to find the residue of surface life in some form.

So far several processes indicating possible biological activity have been identified on Mars and studies have shown that even microbes from Earth have mechanisms to cope with harsh conditions on its surface.

This life may have even been detected before[3], but there are still no unambiguous signals, which could only be attributed to life and not to processes of abiotic origin.

However, recent atmospheric measurements have revealed processes which I believe are likely to have a biological source.

Note that, in this context, biological source (life) is understood to represent what is in modern biology considered to be a living single-celled or multi-celled organism.

2 Hypothesis

Data from the analysis of atmospheric composition in Gale crater shows seasonal variation of CH_4 and O_2 and its correlation with optical depth and UV radiation[4].

It has been proven already that water exists as ice on Mars, as well as perchlorates.

It has been shown that even surface water containing perchlorates (brine) can melt on Mars during spring and summer and that the liquid can also periodically exist in thermodynamically stable states[5]. The periods correspond exactly to observed variations of dielectric permittivity[6].

Since increase in O_2 happens during spring and summer and is correlated with atmospheric radiation absorption, one obvious source are microorganisms:

1. Water molecules are broken through photolysis by UV radiation:

$$2H_2O + 4\gamma \rightarrow 4H^+ + 4e^- + O_2$$

2. Providing hydrogen for perchlorate reduction (by microbes):

$$ClO_4^- + 2H^+ + 2e^- \rightarrow ClO_3^- + H_2O$$

$$ClO_3^- + 2H^+ + 2e^- \rightarrow ClO_2^- + H_2O$$

$$ClO_2^- \rightarrow Cl^- + O_2$$

$$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$$

The net result of above steps is a release of $2O_2$ (water content remains the same).

Methane (CH_4), stored at some point below, gets released too as brine melts.

Replenishment of this methane can also be done by microbes (methanogens):

$$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$$

However, the issue with biological source of the phenomena is the UV radiation itself - it kills microbes.

Therefor, there must be a mechanism in place which allows microbes to survive.

Note that a species of life already exists on Earth capable of surviving radiation on Mars. However, the problem for extremophiles on Mars' surface is not only radiation, but strong oxidizers such as perchlorate salts and dry conditions.

For this reason, I hypothesize that life is a bit deeper where oxidative stress is lower, although I do not exclude the possibility of even more extreme extremophiles with strong regeneration capabilities - after all, life and its environment do co-evolve. Their non-existence in same space/-time may be solely the consequence of phase shift.

Phase shift explains the presence of organisms on Earth optimized for much harsher environments than currently present on Earth - this includes not only radiation, but dryness, saltiness, high pressure and CO_2 levels.

Such extremophiles on Earth may have even migrated from Mars (and Venus) and are yet to evolve independently on Earth.

The key for survival in harsh conditions on Mars' surface layers is cell symbiosis, one which can ensure protein/DNA repair rate can balance the damage.

I find it extremely unlikely for a form of a symbiotic organism akin to Deinococcus radiodurans and Halococcus not to be present on Mars, although its existence may be vertically shifted in space, as it is horizontally for Deinococcus and Halococcus.

A simple solution is the presence of an electric field, such that the brine is positively polarized and [real] ground negatively. In that scenario the perchlorate reduction by microbes does not happen at all (or, at least not on surface), but hydrogen (or, some of it) recombines in the soil where it is used for methane production, without involving serpentinization (although, this too can occur on Mars).

Dust storms on Mars can be global, frequent and large phenomena with strong electric fields being generated through interactions between dust particles and the atmosphere[7].

In these interactions the atmosphere becomes positively polarized.

Interaction of storms with brine could also generate positive ions on brine surface, but here the atmosphere can neutralize by taking electrons produced by UV.

Hydrogen recombination must happen at sufficient depth, out of reach of UV radiation and cosmic rays. The transfer of hydrogen ions thus must be performed by proton conductors.

Water ice itself is a proton conductor, albeit, in pure form, a poor one. However, it would be enough to start gas production at the other end, especially considering the large cross-section of the conductive column.

Produced gas would be trapped below ice resulting in pressure buildup. This would produce heat and cracks in the ice. These gas buffers would eventually reach surface, enabling a better proton conductor to reach the surface - Mars's hair.

The hair might even have a layer of salts/perchlorates to enable liquidity of the channel when gas pressure is low. This would be the outer layer of hair and could be the source of perchlorates on the surface of Mars (UV radiation would cause the breakup of the layer).

Since Mars is, like Earth, roughly a brain, litosphere is the bone layer, crust is - crust, if conditions allow it, one can expect to grow some hair from the crust after the brain is formed (trees would be a precursor to this hair - lanugo).

The effect of UV radiation on hair, especially in water, is negligible - and it regrows when damaged. Of course, the hair of homo.omega should be more advanced than ours, possibly having a tree structure and might be used as antennae for communication. These carbon fibers could be kilometers long and microscopic in width, at least on top, and could also serve as an elevator for microorganisms.

The $\mathrm{CO_2}$ is generated in real crust, by microbes (also providing a sink for $\mathrm{O_2}$ and methane):

$$C + O_2 \rightarrow CO_2$$

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

It is transferred up by the same channels to methane generators.

Real crust acts as a virtual (img) core, providing heat for virtual (img) mantle and enabling liquid water at this layer.

> Note that, in craters such as Gale, situation is somewhat different. The impact has ejected img surface material exposing real surface (crust), but the same mechanism can still exist there.

Assuming ratio of crust to mantle is the same as on Earth one can calculate the thickness of the top layer on mars (img crust):

$$\begin{aligned} d_{(\text{Mars img crust})} &= \frac{d_{(\text{Earth crust})}}{d_{(\text{Earth crust + mantle})}} * d_{(\text{Mars img crust + img mantle})} \\ &= \frac{5+50}{5+50+2*2900} 1500\,m = 14.09\,m \end{aligned}$$

This is the average thickness, minimum thickness would be ≈2.54 m.

Water should exist dispersed, concentrated mostly in small pockets, except on south pole, where, like on Earth's Antarctica, should lie the entrance to

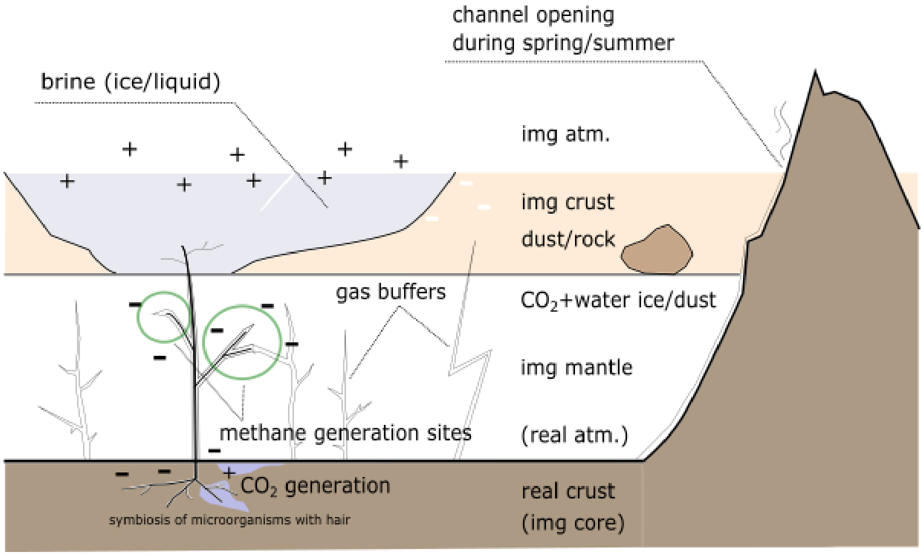

Figure 1: Mars surface ecosystem model (not to scale)

a tunnel connecting surface with deep brain layers - the tunnel used during brain layer formation to transfer differentiated progenitor cells (new neurons) to a designated brain layer (although it may be open only during events of neurogenesis - mass *extinctions*).

A large body of liquid water has been detected on Mars' south pole at 1.5 km depth[8].

The detected lake is ≈20 km wide, surrounded by elevated ground, except on the east side where a depression has been detected.

No other bodies of liquid subsurface water have been detected so far, but the resolution of the instrument used (MARSIS) is not sufficient to detect smaller pockets of water (below couple kilometers in diameter).

UPDATE: More lakes have later been detected nearby[9].
Some, however, are not convinced that any of these bodies are lakes of water, rather some other material (smectites)[10], arguing that required salt and heat concentration for maintenance of liquid water is implausible given what is currently known about Mars.
But what do *we* know about Mars?
I do know that *we* are constantly surprised by Mars (ie. no one was expecting recent volcanic activity on Mars, the problems of Insight and Perseverance with ground digging/drilling, 10 times stronger crustal magnetization than expected[11], etc.) and all other bodies of the Solar System (including Earth).

If Mars is still alive (according to my hypotheses, it should be), global crustal heating should not be surprising.
There are over a hundred of volcanoes under Antarctica and there are hundreds of subglacial lakes there. At times Mars's surface is habitable, its south pole should not differ much from current Earth's south pole.
It is still possible that detected bodies on Mars' south pole are not bodies of liquid water at this point, however, some of these should certainly be the locations of basins and drains used during strong neurogenesis events.
The drains might be closed with clay when unused, but if they are open or opening, the basins should contain liquids.
The presence of liquids could then be interpreted as a signal of upcoming strong neurogenesis events.
If these events are roughly synchronized between Earth and Mars, it is possible that adult neurogenesis is currently upcoming on Mars - while Earth's surface is decreasing habitability, Mars would be increasing its surface habitability. Increasing volcanism and magnetism on Mars go in favor of the hypothesis (assuming *we* do not attribute strong magnetism to rocks magnetized billions of years ago).
If Mars is indeed waking up, *we* should expect more, and increasing rate of, surprises.

I believe Mars did not loose all of its atmosphere, its troposphere condensed and solidified, pressure dropped in order to conserve the equilibrium temperature (note that average Mars' *surface* temperature is equal to the temperature at the top of Earth's troposphere, -60°C).

Electric discharges between img surface and real crust are thus the equivalent of Earth's atmospheric discharges.

Solidification was complete after formation of a final brain layer (I) and high volcanic activity induced by cometary bombardment (also providing new water).

Pressure was increased from 1 atm to just enough needed for solidification. After that point, magnetic field continued contracting below surface, pressure was dropped to 1/100 atm and remains of ionosphere rebounded (the same will happen on Earth, the end result should be similar to Mars' but with higher surface temperature and pressure).

There are microbes living currently on Earth, which can survive pressure of 6 mbar, temperature of -60°C and 95% CO_2 atmosphere[12] of Mars. These may be considered as a precursor or a consequence of phase shift in time.
Note that, at the time of compression, Mars had significant water content in its hydrosphere. The compression must have resulted in strong crustal hydration, creation of hydrates and perhaps other clathrates.

UPDATE: Recent research shows that significant amount of Mars' water (up to 99%) was not lost to space, but was rather stored in crust[13].

At time of compression, the troposphere contained mainly CO_2, water and dust. During solidification some CO_2 dissolved in water but some remained on top as CO_2 ice (dry ice). Over time, the layer of pure CO_2 ice sublimated, except on poles where, due to lower temperatures, remains preserved (renewed).

At the point of solidification, atmospheric discharges were at maximum. Induced heat of discharges alone could have created initial channels connecting the top surface with the crust.

Plants can live at these pressures and it is expectable for them to grow higher in high CO_2 conditions.

Since, at the point of strong evolution, CO_2 is abundant - trees evolve, to reach extreme heights, extremely small width due to high pressure and life in dark environments due to *polluted* atmosphere.

With a suitable catalyst, UV radiation is breaking water molecules in liquid water, making photosynthesis obsolete - the plant simply collects free radicals from water.

The plant forms the symbiosis (or fusion) with microbes, such that it delivers hydrogen/oxygen to them. In return, microbes clean the plant by processing dead cells - taking carbon, and releasing methane/carbon-dioxide. Effectively, the tree evolved to an ion conductor (electrolyte) in electrolysis.

There's a good possibility that ancestors of microbes/plants living there today have been engineered by Mars' humans to battle the atmospheric CO_2 increase, just like we are doing today on Earth[14].

Plants also deliver water from ground to atmosphere, so they might be creating water buffers at upper layers.

This biosphere thus has a separate carbon/oxygen cycle from the abiotic one in the atmosphere with which it only seasonally interacts.

Because the visible surface on Mars may generally not be the surface where complex lifeforms ever lived, one cannot expect to find any evidence of such life there.

But, below the ice (condensed troposphere), in the real crust of Mars one can expect to find both, extant and extinct life (humanoid fossils included).

Of course, below the crust, particularly below litosphere, Mars should be full of diverse life.

Overall, this biosphere is, like all natural processes on Earth, just a part of planetary symbiosis ranging from the atmosphere to the core, forming a homo.omega individual.

3 Testing the conditions

I have tested the viability of proton transfer through water ice. The solution included a residue from electrolysis (copper oxide, iron oxide), residue from pencil sharpening (graphite, 2-3 slices of wood), and, unplanned, 4 dead flies (the solution waited some time for the experiment..):

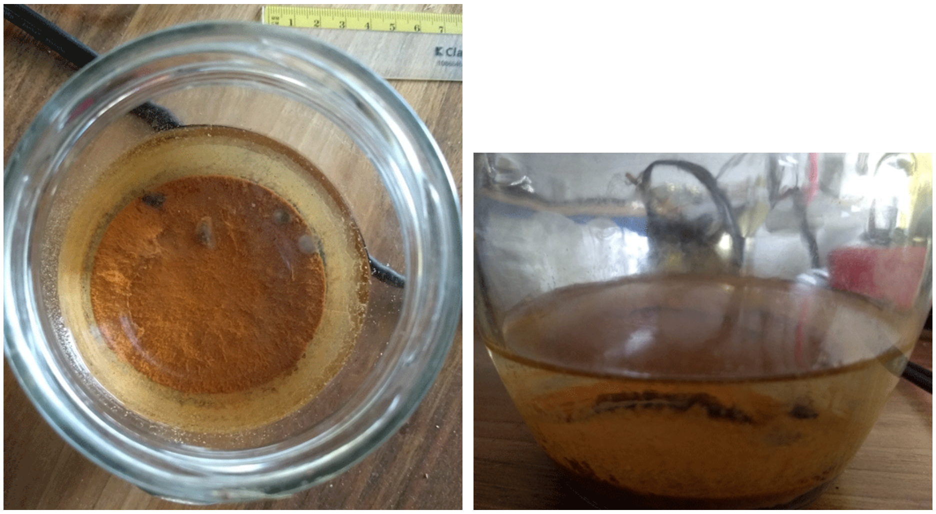

Figure 2: The solution

A copper electrode with gold plated contact was added, to be used as cathode:

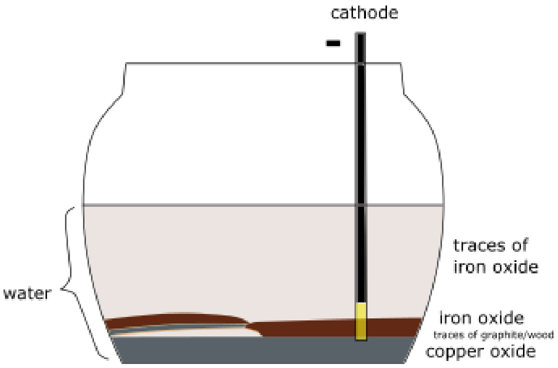

Figure 3: Solution with cathode added

After freezing on -23°C for 18 hours, the copper anode and water were added to the solution:

A couple of minutes after exposing the solution to +22°C room atmosphere

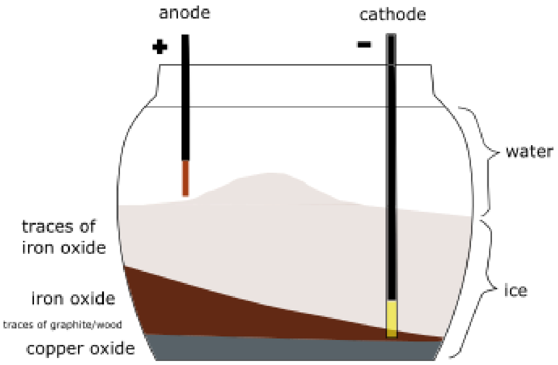

Figure 4: Solution after freezing

and connecting the electrodes to a 4.0 V DC source, the voltage was observed to be dropping (the instrument doesn't detect changes below 1 mV).

> Average temperature on Mars is -63°C, but the temperature can go up to 30°C in summer.
> Note that due to extremely low pressure, temperature on Mars doesn't feel as cold as on Earth (-70°C on Mars would feel as -34°C on Earth), making maintenance of temperature less challenging for complex organisms.

After 20 minutes the oxidation of copper on the anode was becoming clearly visible (to naked eye). By now some ice on the edges melted and small amount of water was now under the ice.

The cathode, however, was still inside the ice and hydrogen was not coming out, indicating that protons (hydrogen ions) are being *delivered* to cathode through ice and that hydrogen gas is building up inside the ice.

After 45 minutes bubbles of hydrogen were observed to come out of the bottom of the ice. The bubbles were large and the bubbling was not continuous, further confirming the buildup inside the ice.

Scaling this to Mars, a required voltage for the same current would be:

$$U_1 = \frac{d_1}{d_0} \frac{{r_0}^2}{{r_1}^2} U_0 = 960V$$

for U_0 = 4 V, d_0 = 0.04 m = thickness of the ice in the solution, d_1 = 1500 m = thickness of the ice cover on Mars, r_0 = 0.08 m = cross-section radius of ice in the solution, r_1 = 1 m = cross-section radius of the ice column on Mars.

This is a very low voltage requirement, easily achievable on Mars. Of course, the usage of the cross-section radius parameter in such form and value is debatable, but actual requirements for the phenomena are much lower due to following:

- although I have used 4 V, electrolysis would occur on lower voltages too, even more efficiently,
- the possibility of proton transfer is important in this case - not the strength of current,
- available cross-section area for proton current is very large on Mars,
- I have used freshwater with no significant salt content - salty hair in the solution would increase conductivity,
- average ice column on Mars should be shorter than 1.5 km - CO_2 (dry) ice layer only occurs on the poles.

The phenomena has very low requirements overall, but if there are specially evolved proton conductors (plants/hair) on Mars, the voltage is not an issue and ion exchange becomes much easier. And if conditions are there, life should be there.

References

[1] Complete Relativity: Nature of Observables (2021), Amenoum
https://amenoum.org/complete_relativity.html

[2] The Solar System: Nature and Mechanics (2021), Amenoum
https://amenoum.org/solar_system.html

[3] I'm Convinced We Found Evidence of Life on Mars in the 1970s (2019), G. V. Levin
https://blogs.scientificamerican.com/observations/im-convinced-we-found-evidence-of-life-on-mars-in-the-1970s/

[4] Seasonal variations in atmospheric composition as measured in Gale Crater, Mars (2019), M. G. Trainer et al
https://doi.org/10.1029/2009GL037497

[5] Stability of perchlorate hydrates and their liquid solutions at the Phoenix landing site, Mars (2009), V. F. Chevrier et al
https://doi.org/10.1029/2009GL037497

[6] Mars regolith thermal and electrical properties: Initial results of the Phoenix Thermal and Electrical Conductivity Probe (TECP) (2009), A. P. Zent et al

[7] Detecting electrical activity from Martian dust storms (1999), W. M. Farrell et al

[8] Radar evidence of subglacial liquid water on Mars (2018), R. Orosei et al
https://doi.org/10.1126/science.aar7268

[9] Characteristics of the Basal Interface of the Martian South Polar Layered Deposits (2021), A. R. Khuller et al
https://doi.org/10.1029/2021GL093631

[10] A Solid Interpretation of Bright Radar Reflectors Under the Mars South Polar Ice (2021), I. B. Smith
https://doi.org/10.1029/2021GL093618

[11] Crustal and time-varying magnetic fields at the InSight landing site on Mars (2020), C. L. Johnson et al
https://doi.org/10.1038/s41561-020-0537-x

[12] Astrobiology with haloarchaea from Permo-Triassic rock salt (2003), H. Stan-Lotter et al
https://doi.org/10.1017/S1473550403001307

[13] Long-term drying of Mars by sequestration of ocean-scale volumes of water in the crust (2021), E. L. Scheller et al
https://doi.org/10.1126/science.abc7717

[14] Carbon dioxide-eating bacteria offer hope for green production (2019), E. Callaway
https://doi.org/10.1038/d41586-019-03679-x